GATES LEARJET CORPORATION

maintenance manual

CHAPTER

56

WINDOWS

RECORD OF TEMPORARY REVISIONS

Rev. No.	Date Inserted	Date Removed	Page Number	Rev. No.	Date Inserted	Date Removed	Page Number
56-1	Mar 31/78	Oct 16/81 Rev #10	56-10-00 Pg 207				
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Chapter Section Subject	Page	Date
56-Title		
56-Record of Temp. Revisions		
*56-List of Effective Pages	1	May 25/84
56-Contents	1	Oct 16/81
56-00-00	201	Oct 16/81
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56-10-00	201	Oct 16/81
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56-20-00	202	Oct 16/81

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GENERAL - MAINTENANCE PRACTICES

1. General
 A. The windows consist of the windshield and cabin windows.
 (1) The windshield consists of the pilot's and copilot's windshield halves. The two-piece impact resistant plexiglass windshield is secured to the fuselage structure and windshield center post structural members with screws and retainers.
 (2) The cabin windows consist of plexiglass windows secured to the fuselage structure by screws and retainers.
 B. Care must be exercised to avoid scratches or gouges which may be caused by dirty or rough cleaning cloths or grit carried in the water.
 C. All rubbing operations on the windows shall be done with as light a pressure as possible.
 D. Assure that all detergent is completely removed after cleaning to prevent staining and/or paint damage.

 CAUTION: DO NOT USE THE FOLLOWING MATERIALS ON ACRYLIC PLASTICS: GASOLINE, ALCOHOL, BENZENE, HEXANE, XYLENE, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER, OR DE-ICING FLUIDS, LACQUER THINNERS OR WINDOW CLEANING SPRAYS, AS THEY SOFTEN THE PLASTIC AND/OR CAUSE CRAZING.

2. Tools and Equipment
 A. The following materials are required.

NAME	NUMBER	MANUFACTURER
Aliphatic Naptha Type II	TT-N-95	Commercially Available
Mild detergents (non-abrasive)		Commercially Available
Chamois Skins or Soft Cloth		Commercially Available

3. Cleaning/Painting
 A. Clean Windows
 (1) Remove loosely adhering dirt and grit from the window by flushing with water filtered free of dirt and abrasive materials.
 (2) Use a soft, thoroughly clean cloth, sponge or chamois to carry soapy water to the window. Go over the surface only with the bare hand so that any abrasive can be quickly detected and removed before it scratches the plastic surface.
 (3) Thoroughly rinse window with clean water to assure all detergent is removed.

CAUTION: RUBBING THE PLASTIC SURFACE WITH A DRY CLOTH WILL CAUSE SCRATCHES AND BUILD UP AN ELECTRO-STATIC CHARGE WHICH ATTRACTS DUST PARTICLES. ALL RUBBING OPERATIONS ON ACRYLIC PLASTICS SHALL BE DONE WITH AS LIGHT A PRESSURE AS POSSIBLE.

(4) Dry the window with a clean, damp chamois. A clean, soft cloth or tissue may be used if care is taken not to rub the plastic after it is dry.

(5) Remove oil and grease by lightly rubbing with a cloth dampened with aliphatic naptha.

CAUTION: DO NOT USE THE FOLLOWING MATERIALS ON ACRYLIC PLASTICS: GASOLINE, ALCOHOL, BENZENE, HEXANE, XYLENE, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER, OR DE-ICING FLUIDS, LACQUER THINNERS OR WINDOW CLEANING SPRAYS, AS THEY SOFTEN THE PLASTIC AND/OR CAUSE CRAZING.

FLIGHT COMPARTMENT WINDSHIELD - MAINTENANCE PRACTICES

1. General
 - A. The flight compartment windows consist of the pilot's and copilot's windshield halves.
 - B. The windshield is made up of three laminated layers of acrylic plastic. Both outer layers are made of stretched acrylic .460 (+.046/-.030) inch thick. The middle layer is cast in place acrylic .060 inch thick.
 - C. The two-piece impact-resistant plexiglass windshield is secured to the fuselage structure and windshield centerpost structural members with screws and retainers.
 - D. Removal and installation procedures are identical for both the right and left windshield with the exception of the amount of primer to be applied.
 - E. When installing a new windshield the old windshield must be retained for use as a template for cutting and drilling the new windshield.
 - F. Replacement windshields do not contain the necessary attach holes. Therefore, special drilling precautions outlined below must be followed when installing a replacement windshield.
 - (1) Recommended drill speeds are: hand drill, 2100 to 2500 rpm, automatic constant speed drill, 2100 rpm.
 - (2) Recommended feed rate is .001 inch per revolution. The drill should be allowed to do all the work with little or no force by the operator. Forcing the drill will cause the backside of the windshield to chip or flake as the drill breaks through.
 - (3) A few practice holes can be drilled in the portion of the windshield which will be trimmed off.
 - (4) During drilling operation the drill should be backed out several times to clear chips and the drill lubricated by dipping in AN-P-51 (vaseline).

2. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
#12 Drill Sharpened to a Point		Manufactured Locally	Drill pilot holes.
3/8" Drill with a #12 Pilot	LUT 9018	Gates Learjet Corp.	Final drilling of holes.
Vaseline	AN-P-51	Commercially Available	Lubricate drills.
Hydrocal	(100# Bag)	Commercially Available	Cast old windshield.
Hemp	(5 pounds)	Commercially Available	Mix with Hydrocal

NAME	NUMBER	MANUFACTURER	USE
Flannel Cloth	(4 yds x 36")	Commercially Available	Protective facing for Hydrocal cast.
Pro-Seal	890B, Class B	Coast Pro-Seal and Mfg. Co.	Seal windshield and retainers.
Super Koropon Green Primer	515-344	Desoto Chemical Coatings Inc.	Paint outer portion of windshield.
Super Koropon Curing Solution	910-350	Desoto Chemical Coatings Inc.	Mix with primer.
Reducer	020X304	Desoto Chemical Coatings Inc.	Thin primer.
Aliphatic Naptha	Federal Spec TT-N-95, Type II	Commercially Available	Clean windshield area to be painted.
Sanding Discs	36 grit	Commercially Available	Smooth windshield edge.
Sanding Discs	320 grit	Commercially Available	Smooth windshield edge.
Abrasive Paper Wet or Dry	220 grit or finer.	Commercially Available	Roughen primer.
Hand Drill	(capable of 2100 to 2500 rpm)	Commercially Available	
Drill Motor	(capable of 2100 rpm)		
Band Saw	(speed for cutting to 4000 fpm)		
Sander			
Reamer	#12	Commercially Available	Ream holes in seal
Step Pins		Manufactured Locally	To locate drill bushings.
Drill Bushings		Manufactured Locally	For windshield drilling operation.

NAME	NUMBER	MANUFACTURER	USE
Adhesive	Silastic 732-RTV White, Translu-scent, or Black	Dow Corning Corp. Midland, Mich.	To bond seals.
	RTV-102 White, RTV-103 Black, RTV-108 Translu-scent, or RTV-106 Red	General Electric	Alternate for Silastic 732-RTV.
Rubber Cement		Commercially Available	To glue flannel to Hydrocal Cast

3. Removal/Installation

A. Remove Windshield (See figure 201)

(1) Remove nose compartment access doors.
(2) Remove external defog nozzle. Refer to Chapter 30.
(3) Remove screws and lower instrument panel. Refer to Chapter 31.
(4) Remove attaching parts securing glareshield and remove glareshield.
(5) Remove headliner and side panels as required.
(6) Remove internal defog diffuser. Refer to Chapter 21.
(7) Remove screws, nuts and washers which pass through the outer center post, inner center post, retainer, windshield and inner angles. Remove inner and outer center posts.
(8) Remove the two rows of screws which secure retainer. Remove retainer and windshield from aircraft.

B. Preparation for Installation of Existing Windshield

(1) Inspect entire surface of windshield for scratches, chips, crazing, and damage of any kind.
(2) If repair is required, refer to Approved Repairs for correct procedure.
(3) Carefully remove any dirt or sealer adhering to the surface of windshield.
(4) Carefully remove peeling primer.
(5) Mask off windshield. Very carefully use 220 grit or finer abrasive paper to feather edges of chipped or peeled areas.
(6) Mix one part super Koropon Fluid Resistant Primer (green) #515-344 and one part Curing Solution #910-350. Thorough mixing with a paddle is sufficient agitation. Use a fine brush to touch up small areas. Add up to 10% of reducer #020X304 to thin primer for spraying large areas. Build up areas of left windshield to a minimum thickness of 0.007 inch and 0.003 inch for right windshield.

NOTE: • If primer is applied in dust free area, additional coats of primer may be added when previous coat is still tacky or when it is just past tacky stage.
• If primer is not applied in a dust free area, allow primer to dry thoroughly. Use fine grit abrasive paper to sand off dust or dirt that may have adhered to primer surface and to roughen surface for next coat.

(7) Allow primer to dry a minimum of two hours prior to application of sealer.
(8) Peel old seals off of inner and outer retainers. Thoroughly clean retainers using clean rags dampened in MEK or equivalent. While parts are still wet, wipe dry with clean cotton rags.
(9) Install windshield.

C. Preparation for Installation of New Windshield
(1) Position removed windshield on a suitable work bench and remove old inserts and bushings from holes in windshield.
(2) Fabricate step pins as shown in figure 201 and install step pins in holes where inserts were removed.
(3) Fabricate drill bushings as shown in figure 201 and install drill bushings on step pins.
(4) Mix hydrocal following manufacturer's instructions.
(5) Saturate hemp in hydrocal and apply around the edge of the windshield as shown. As the hydrocal and hemp mixture begins to set, scrape excess from along sides. Do not let hemp extend over side of windshield.
(6) After hydrocal has set a minimum of one hour, remove step pins and hydrocal cast from windshield.
(7) Using rubber cement, glue flannel cloth to windshield side of hydrocal cast. This will help protect new windshield.
(8) Using care not to scratch new windshield, trim protective paper back approximately two inches from edge.
(9) Position hydrocal cast on new windshield. Assure the cast contour perfectly fits new windshield contour.
(10) Spot drill approximately 10 pilot holes around the windshield using drill bushings cast into the hydrocal cast. Secure cast to windshield by installing bolts through these holes.
(11) Using the hydrocal cast as a blade guide, trim windshield to size using a band saw. Sand the edge of the windshield to remove burrs and rough spots.
(12) Drill remainder of pilot holes around windshield and remove cast from windshield.
(13) Using the 3/8" drill with #12 pilot, enlarge pilot holes to final size.
(14) Sand completely around windshield so that corners are radiused 0.12 inch.
(15) Install windshield.

D. Installation of Windshield (See figure 201)

(1) Install inserts into windshield.

(2) Apply a small amount of liquid soap to the bushings and install into inserts.

NOTE: Inserts and bushings are to be flush with both sides of windshield. If these protrude, trim excess with a razor blade. Always trim toward edge of windshield.

(3) Position outer retainer on windshield and temporarily attach to windshield by inserting screws through retainer and windshield attach holes.

(4) Mask off windshield leaving 0.12 to 0.14 inch between masking tape and inboard edge of retainer.

(5) Remove retainer from windshield and clean unmasked area with aliphatic naptha. Assure that masking tape adheres to windshield and naptha is not allowed to seep under masking tape.

(6) Mix one part Super Koropon Fluid Resistant primer (green) #515-344 and one part curing solution #910-350. Thorough mixing with a paddle is sufficient agitation. Add up to 10% of reducer #020X304 to thin primer for spraying.

NOTE: Unused, mixed primer over eight hours old must be discarded.

(7) Apply a spray coat of mixed primer to unmasked portion of outer windshield to give a dry film thickness of 0.0006 to 0.0012 inch. Apply seven coats to the left windshield and three to the right, to obtain a minimum thickness of 0.007 inch for left windshield and 0.003 inch for the right.

NOTE:
- If primer is applied in a dust free area, additional coats of primer may be added when previous coat is still tacky or when surface is just past tacky stage.
- If primer is not applied in a dust free area, allow primer to dry thoroughly. Use fine grit abrasive paper to sand dust or dirt that may have adhered to primer surface and to roughen surface for next coat.

(8) Allow primer to dry a minimum of two hours prior to application of sealant.

(9) Apply silastic RTV-732 or equivalent adhesive around outer face of inner retainer and around inner face of outer retainer and install new seals.

(10) Using a No. 12 reamer, ream holes in new seal. The retainers should be used as a guide for reaming operation.

(11) Position new windshield on inner retainer. Apply fillet seal along entire inner edge of outer retainer between crimp and seal, immediately prior to installation of outer retainer. Apply sufficient sealant to assure a continuous bead will be forced from under retainer when retainer is secured and torqued.

(12) Position windshield on aircraft and position outer retainer on windshield.

(13) Position inner and outer center posts on aircraft.

(14) Secure center posts and outer retainer with screws, nuts and washers. Torque to 30 inch-pounds (3.387 N.m).

NOTE: Prior to installing screws through the windshield, the threads should be dipped in sealant.

(15) Remove excess sealant from windshield using approved cutting tool and soft clean cloth.

(16) Install bolts, nuts, and washers which secure inner angles together.

(17) Pressure test aircraft to 9.5 psi (65.500 kPa) and check for leaks. Maximum allowable leakage is 115 SCFM.

(18) After pressure test, back windshield screws off and retorque to 30 inch-pounds (3.387 N·m). If screw turns when backing off nut, reseal screw body as required.

(19) Fill two lower center post screw holes with aerodynamic fairing compound.

(20) Install internal defog diffusers. Refer to Chapter 21.

(21) Install external defog nozzle. Refer to Chapter 30.

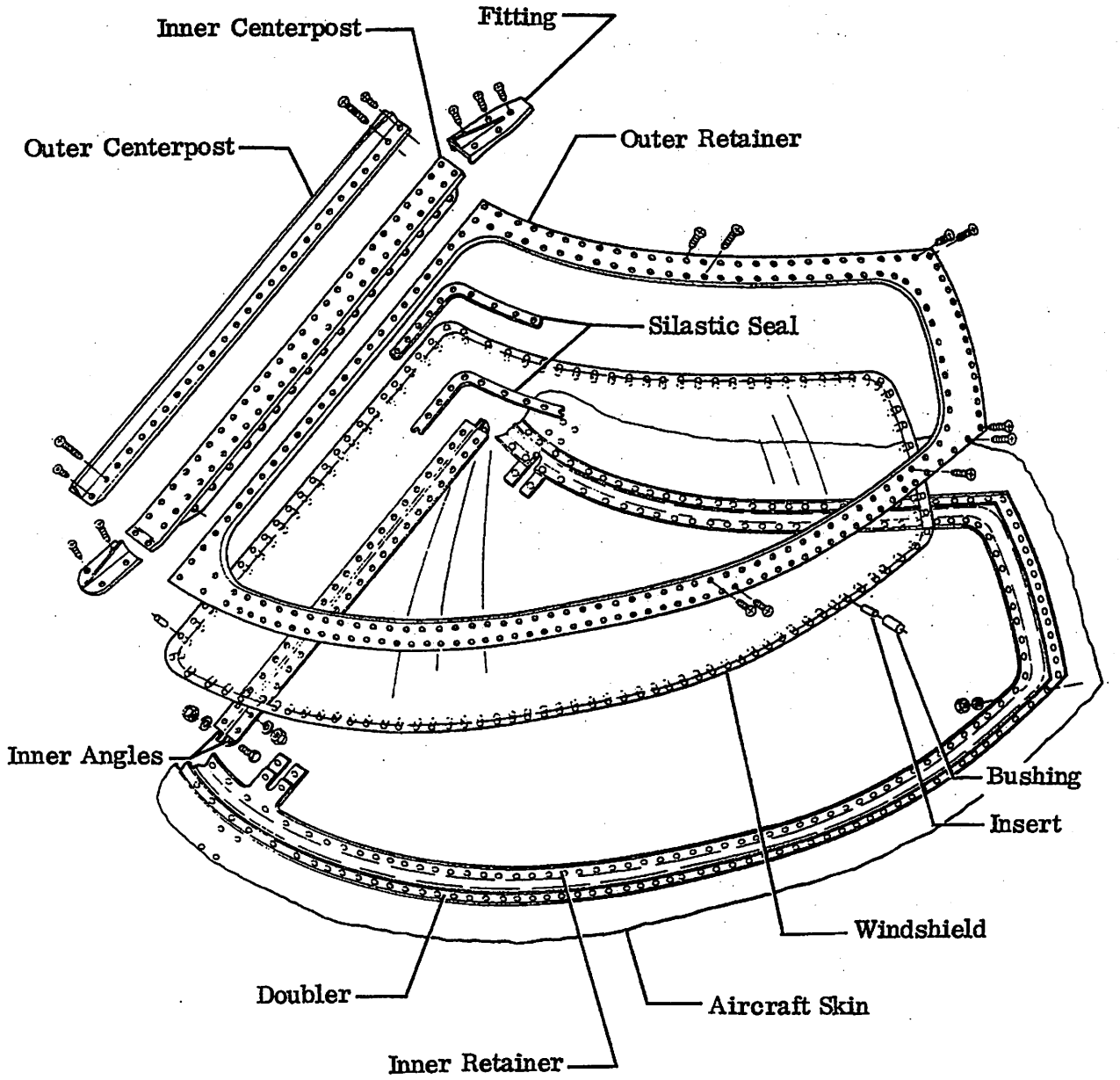
(22) Install side panels and headliner.

(23) Install glareshield.

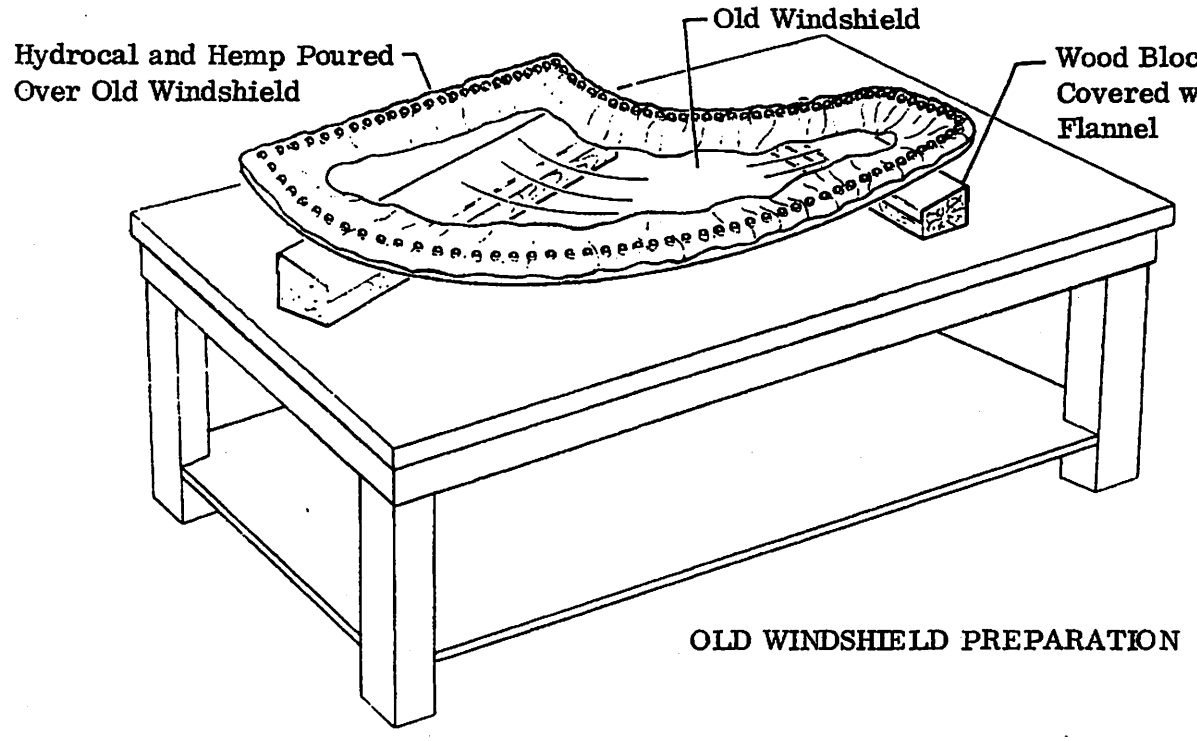
(24) Raise instrument panel and secure with screws.

(25) Install nose compartment access doors.

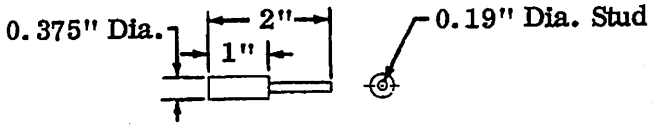
(26) Remove protective paper from windshield and clean if necessary.



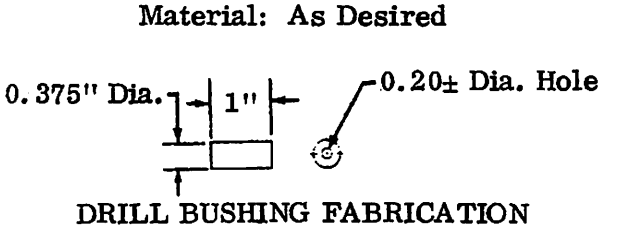
Windshield Installation
Figure 201 (Sheet 1 of 3)



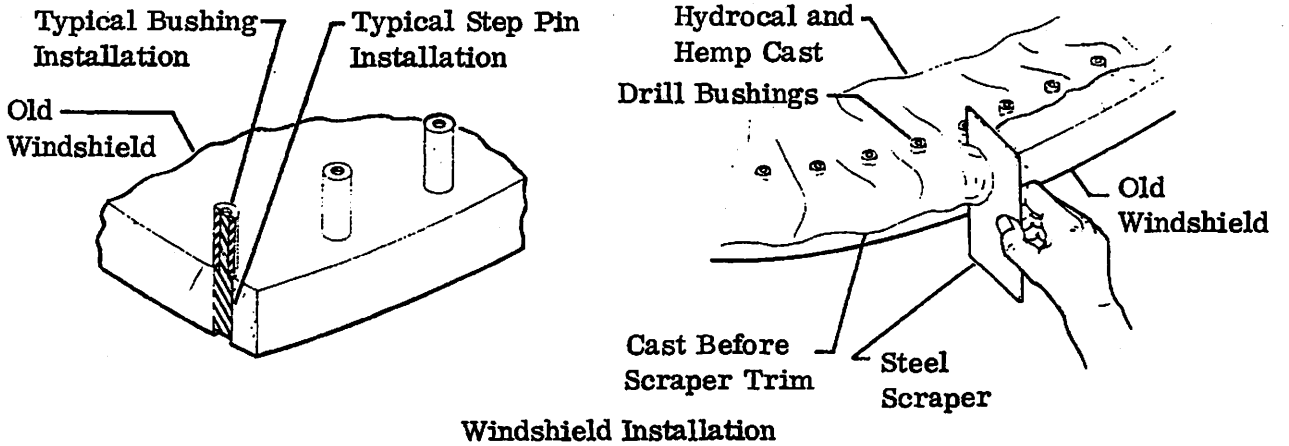
OLD WINDSHIELD PREPARATION



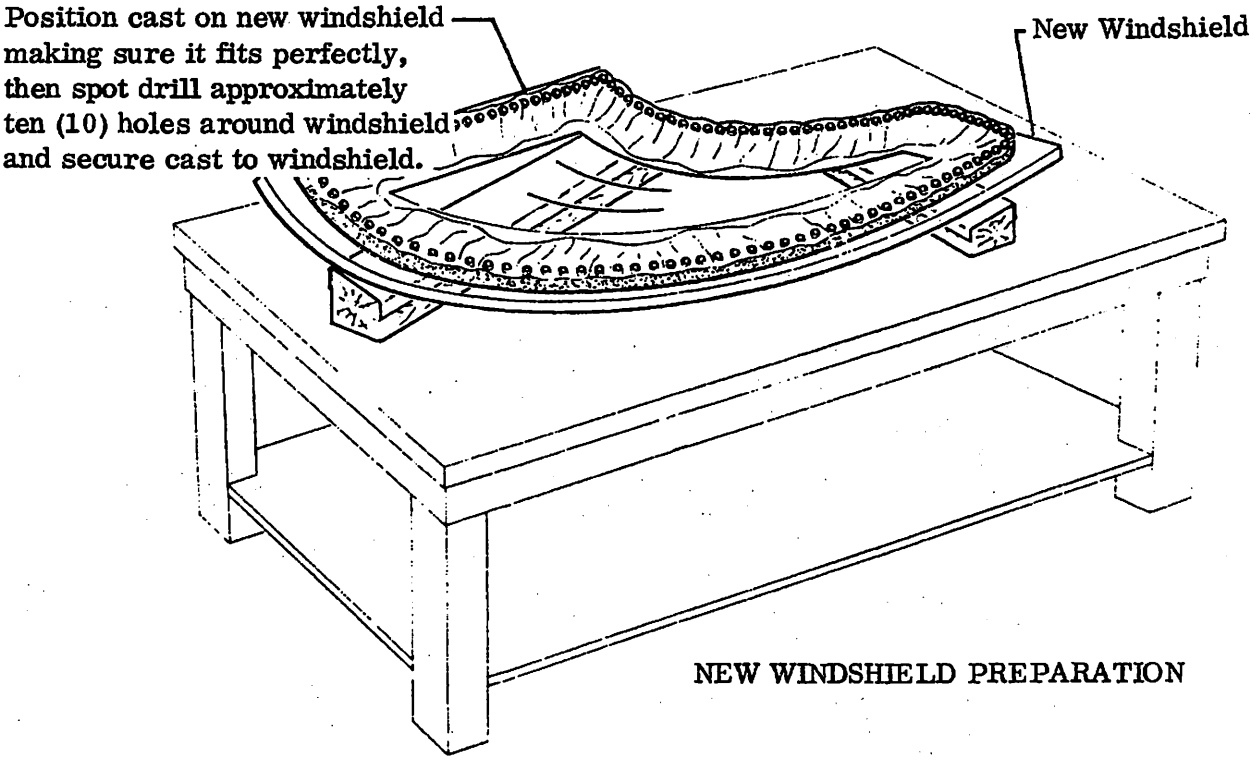
STEP PIN FABRICATION



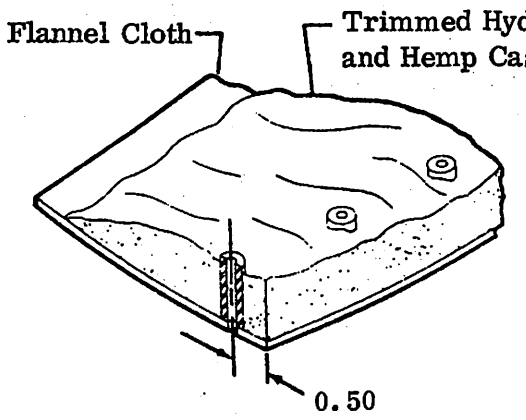
DRILL BUSHING FABRICATION

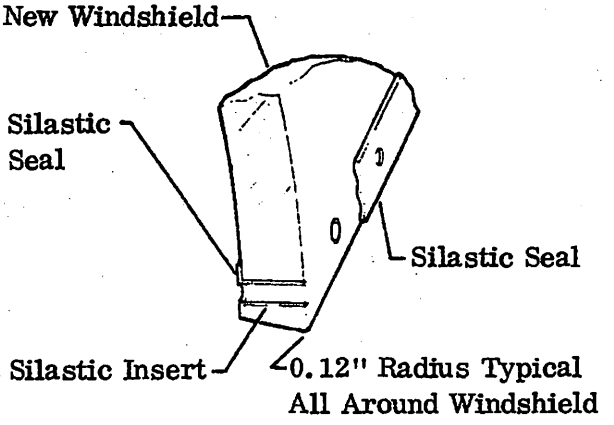


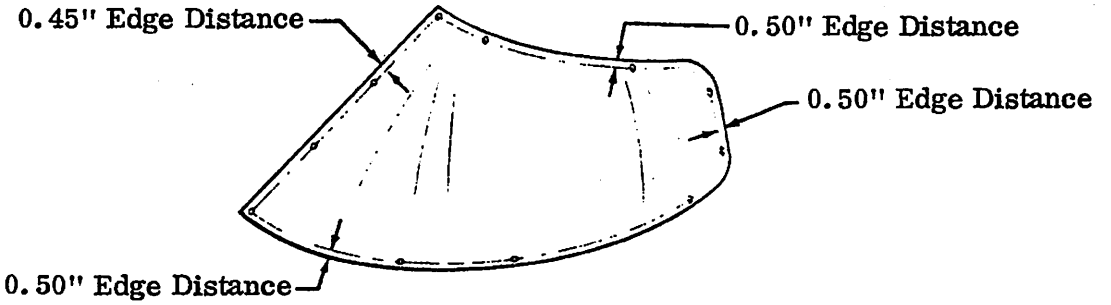
Windshield Installation
Figure 201 (Sheet 2 of 3)



NEW WINDSHIELD PREPARATION







Windshield Installation
Figure 201 (Sheet 3 of 3)

4. Approved Repairs

A. Windshield and Cabin Window

(1) A thorough analysis of windshield or cabin window damage must be made before attempting any repairs.

(2) Normally, light scratches or small pits can be repaired without reducing the structural integrity or reducing the optical quality of the windshield or cabin window.

(3) In some instances repairs may be allowable with respect to the structural integrity of the windshield or cabin windows, but not allowable with respect to the optical distortion incurred.

(4) Scratches or pits which require removal of material that reduces windshield thickness to less than 1.0 inch (2.54 cm) are not permitted.

(5) Scratches or pits which require removal of material that reduced the outer window glass thickness (outer laminate layer) to less than 0.400 inch (10.16 mm) are not permitted.

(6) Optical distortion of the windshield or cabin windows caused by repairs is considered the responsibility of the owner, crew, and/or the facility performing the repairs.

NOTE: Service experience has shown that removal of scratches greater than .005 inch (0.12 mm) deep in the extreme curvature of the windshield often results in optical distortion which is not acceptable.

B. Removal of Scratches or Pits from Windshield or Cabin Windows

(1) Tools and Equipment

NAME	PART NUMBER	MANUFACTURER
Ultrasonic Thickness Gage	Caliper Model No. CL-202	Radiatronics P.O. Box 1230B Overland Park, Ks. 66212
Abrasive Paper	400A & 600A Grit Wet or Dry	Available Locally.
Polishing Compound	Cerium Oxide #2	L. L. Fusco Company 4937 Olympic Blvd. Los Angeles, Calif.
Rubber Block	40-50 Shore H (Medium-Hard)	Available Locally.

NAME	PART NUMBER	MANUFACTURER
Cotton Flannel Cloth		Available Locally.
Cleaner	403D Federal Spec. P-P560 Type I	PermaTex Kansas City, KS 66115
Cleaner	Wilco Anti-Static Cleaner	Wilco Company Los Angeles, Calif.
Wax	Simonize Paste Auto Johnson Paste Auto DuPont Paste Auto	Available Locally

(2) Using an ultrasonic thickness gage determine the thickness of the glass adjacent to the scratch or pit. Follow the manufacturer's operating instructions for the instrument.

(3) Using a depth gage or other similar device measure the depth of scratch or pit as accurately as possible.

(4) Using the thickness measured in step (2) and the depth of the scratch or pits as measured in step (3) determine whether repairs are allowable.

NOTE: • Scratches or pits which require removal of material that reduces windshield thickness to less than 1.00 inch (2.54 cm) are not permitted. In such cases the windshield must be replaced.

• Scratches or pits which require removal of material that reduces outer cabin window thickness to less than 0.400 (10.16 mm) are not permitted. In such cases, the cabin window must be replaced.

(5) Thoroughly clean windshield or cabin window to be repaired. This will remove all foreign matter which may cause more scratches when repairs are begun.

CAUTION: • EXTREME CARE MUST BE USED DURING REPAIRS TO PREVENT VIEW DISTORTION.

• DO NOT USE SANDING BLOCK IN A BACK-AND-FORTH MOTION.

(6) Wrap abrasive paper (400A, wet or dry) around a rubber sanding block.

(7) Using large amounts of water, lightly sand over and around the imperfection in a circular motion. Sand an area 2 to 3 times that of the imperfection in order to minimize optical distortion and excessive thinning.

(8) Continue sanding lightly, using large amounts of water, until the initial imperfection is no longer apparent.

(9) Change to 600A, wet or dry abrasive paper.

(10) Using large amounts of water, continue to lightly sand until the hairline scratches caused by the first sanding are no longer apparent. Sand an area 2 to 3 times larger than covered by the first sanding to minimize optical distortion and to "feather" out the repaired area.

(11) Mix cerium oxide #2 with water to form a thin paste.

NOTE: Poly-Sand may be used in lieu of cerium oxide #2. Follow manufacturer's instructions.

(12) Wrap sanding block in 2 or 3 layers of clean cotton flannel cloth to form a polishing pad.

CAUTION: DO NOT ALLOW CERIUM OXIDE #2 PASTE TO BECOME DRY.

(13) Apply cerium oxide paste to surface of windshield or cabin window and lightly rub in a circular motion. Constantly add water to prevent paste from drying out and increase area of circular motion.

(14) After sanding marks are removed, continue rubbing with polishing pad. Do not apply additional paste to rework area, just water. Continue rubbing surface while adding water. This action will restore a glossy surface to the windshield or cabin window.

(15) Using a clean cotton flannel cloth, dry surface of windshield or cabin window.

(16) Apply cleaner with clean cotton flannel cloth. After cleaner has dried, wipe off cleaner film.

(17) Apply wax and polish surface to a high gloss.

(18) After completion of repairs, the windshield must be inspected by the aircraft owner, crew, and/or facility performing the repair work to determine whether the optical distortion (if any) is acceptable.

NOTE: This inspection should be performed under both daytime and night time conditions.

C. Removal of Scratches or Pits from Windshield or Cabin Windows (Micro-Mesh Scratch Removal and Restoration Kit)

(1) Tools and Equipment

NAME	PART NUMBER	MANUFACTURER
Scratch Removal and Restoration Kit	HP 100	Micro-Surface Finishing Prod. Inc. Box 456 Wilton, Iowa 52778 (Available thru Gates Learjet Corp.)

(2) Using an ultrasonic thickness gage, determine the thickness of the glass adjacent to the scratch or pit. Follow the manufacturer's operating instructions for the instrument.

(3) Using a depth gage or other similar device, measure the depth of scratch or pit as accurately as possible.

(4) Using the thickness measured in step (2) and the depth of the scratch or pits as measured in step (3) determine whether repairs are allowable.

NOTE:
- Scratches or pits which require removal of material that reduces windshield thickness to less than 1.00 inch (2.54 cm) is not permitted. In such cases the windshield must be replaced.
- Scratches or pits which require removal of material that reduces outer cabin window thickness to less than 0.400 inch (10.16 mm) is not permitted. In such cases the cabin windows must be replaced.

(5) Perform windshield or window repairs. Carefully follow manufacturer's instructions included in the kit.

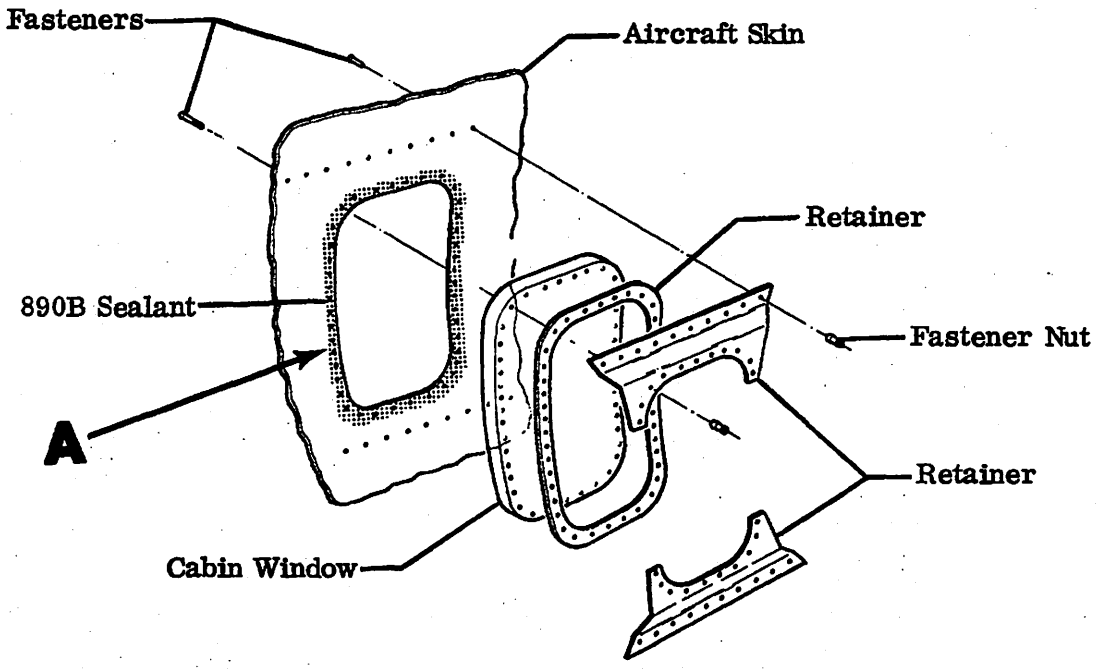
CABIN WINDOW - MAINTENANCE PRACTICES

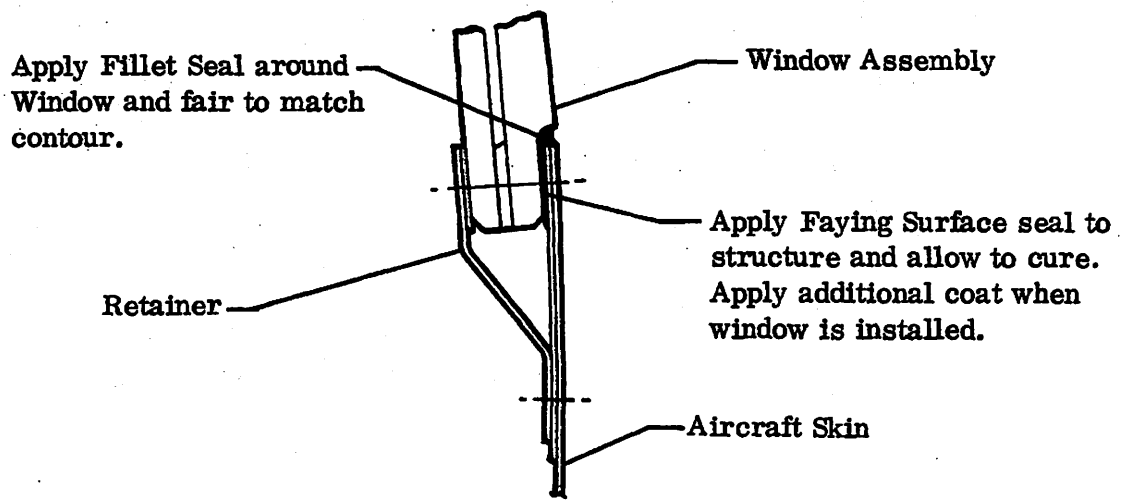
1. General
 A. There are nine cabin windows installed in the aircraft including the emergency exit door window.
 B. The cabin windows are made up of two panes of acrylic with a dead air space between them. The two panes are held apart and sealed air tight by a spacer. The outer pane is stretched acrylic .414 inch thick. The inner pane is stretched acrylic .252 inch thick. The air space between panes is .090 inch.
 C. Removal and installation procedures for the cabin windows are identical with the exception of the emergency exit door window.

2. Removal/Installation
 A. Remove Cabin Window (See figure 201)
 (1) Remove the upholstery in the immediate area of window to be replaced.
 (2) Remove foam as required to gain access to window retainers, using a sharp knife or other suitable instrument.
 (3) Insert a small allen wrench into the shank portion of fastener and, using allen wrench to hold fastener stationary, loosen and remove nuts securing window retainers and window.
 (4) Remove window retainers and window.
 B. Install Cabin Window (See figure 201)
 (1) Remove old sealant from structure. Refer to 20-00-00.
 (2) Apply a faying surface seal, approximately two inches wide, around perimeter of window cutout in aircraft structure. Allow sealant to cure before proceeding with installation.
 (3) After sealant has cured, apply an additional faying surface seal to mating surfaces of aircraft structure and window.
 (4) Insert four fasteners through cabin window attaching holes, equally spaced around perimeter.
 (5) Install window and retainers over fasteners. Install fastener nuts and tighten finger-tight.
 (6) Install remaining fasteners and tighten finger-tight.
 (7) Torque fasteners in a clockwise direction starting at 12, 3, 6, and 9 o'clock. The fastener nuts incorporate a break-off torque limit. This assures that the fasteners will be correctly torqued.
 (8) Clean areas, install upholstery and touch up exterior as necessary.

3. Approved Repairs

 A. Refer to 56-10-00 Approved Repairs, Windshield and Cabin Window.





Detail A

Cabin Window Installation
Figure 201